

Mid-Term Review

10 December 2018, Brussels

Stewart, LEITH
ESR14, WP3



ESR14, WP3 - Background

- Background: Bachelor and Masters in Mechanical Engineering
 - Intern – IAEA (Vienna, Austria), 11/2014-04/2015
 - Project Engineer – MHPSA (Johannesburg, South Africa), 05/2015-01/2018
- Contract start date: 01/02/2018
- Host institute: University of Siegen
- EASITrain Supervisor(s): Dr Michael Vogel
- PhD Title: Production of superconducting thin films for large scale particle accelerators
- PhD University: University of Siegen
- Planned secondments:
 - CemeCon AG (Germany), 02.2019, +-2 weeks, in-depth PVD coating training, including use of CemeCon CC800 coating machine
 - CERN (Switzerland), +- 1 month, (Mid-2019) PVD coating of cavities. Full life cycle of samples from surface preparation to deposition



Role in the Project & Objectives

- Synthesis of low temperature superconducting thin-film coatings on copper substrates. Focused on A15 (Nb_3Sn) and B1 (NbN) type of materials.
- Production of a quality assessment matrix based on microstructural and electrical properties as a function of substrate type and substrate temperature.
- Correlation of essential process parameters with the thin-film structure and its characteristics. RF characteristics will be determined by ESR 8 at HZB
- Optimisation of surface handling and preparation procedure to improve final coatings
- **Objectives:**
 - Completion of PhD within 3 year time frame
 - Gain valuable knowledge which will significantly aid with my future career
 - Engage with the scientific community at large to form a network of like-minded individuals
 - Gain insight into the processes involved in large scale international research projects and enhance project management skills through the exposure provided to me



Research, Methodology, Results & Next Steps

- **Methodology**

- Complete coatings of different materials with various deposition parameters in a statistical fashion to determine their effects and any interdependencies
- Complete full characterisation studies to understand the outcomes of changes in parameters and optimise the process accordingly

- **Results**

- Initial results of Nb and NbN on copper provided a good understanding of the process and how to continue with future tests
- Initial results of chemical polishing and electropolishing have proved insightful.

- **Next Steps**

- Begin next step in niobium nitride deposition (new deposition technique) and enhance knowledge in material characterisation
- Further testing and optimisation of the surface handling and preparation process



Training, Conferences & Workshops

- **Training**

- CERN EASITrain Kickoff Training, Geneva (Switzerland), 03/2018
- Media training at Terra Mater (during EASISchool 1), Vienna (Austria), 09/2018
- EASISchool 1, Vienna (Austria), 09/2018
- “General Accelerator Physics” Lectures, Siegen (Germany), Summer semester 2018.
- German language course A1.2 completed (A2.1 Started), Siegen (Germany)

- **Conferences**

- FCC Week 2018, Amsterdam (Netherlands), 04/2018
- 8th International Workshop on Thin Films, Legnaro (Italy), 10/2018

- **Attended EASITrain events**

- CERN EASITrain Kickoff Training, Geneva (Switzerland), 03/2018
- FCC Week 2018, Amsterdam (Netherlands), 04/2018
- EASISchool 1, Vienna (Austria), 09/2018



EASITrain – European Advanced Superconductivity Innovation and Training. This Marie Skłodowska-Curie Action (MSCA) Innovative Training Networks (ITN) has received funding from the European Union’s H2020 Framework Programme under Grant Agreement no. 764879

Outreach, Dissemination & Networking

- **Outreach activities**
 - Planning to complete EASITrain story
 - Looking to join in scientific discussion with non-scientific communities
- **Dissemination activities**
 - Presentation: FCC Week 2018
 - Presentation: 8th International Workshop on Thin Films 2018
- **Networking activities**
 - The Kickoff at CERN provided the opportunity to meet the group involved with thin film deposition and SRF as a whole. A great opportunity to gain knowledge
 - FCC week permitted interaction with researchers in the particle accelerator community from around the world. Great feeling of pushing boundaries with scientific progress
 - Thin film workshop to present my initial results and receive feedback from experts on any problems being experienced



Impact

- Increased knowledge regarding the performance of alternative materials to niobium. This will provide possibilities for increased performance and cheaper operation of accelerators around the world.
- Alternative materials could provide cross-sectoral applications, especially in the electronics area
- Impact of being part of an MSC fellowship:
 - A chance to experience cutting edge science and to gain valuable insight into how to complete scientific studies professionally
 - Meeting like-minded young scientists who are all pushing each other to produce the best research possible. A great way to push your career forwards
 - The opportunity to attend different schools and conferences around the world, thereby growing my professional network and helping my future career
 - Amazing opportunity to experience a different culture, thereby expanding my horizons, and also to travel throughout Europe



Conclusion

- Very informative and successful start to the project. The base learning phase is now over and more specific knowledge acquirement is underway
- Progress remains on track with a lot of good results already achieved. A clear plan for the future is in place as well.
- Minimal risks foreseen at present and deliverable deadlines are not in jeopardy
- PhD completion within three years remains on track.
- Supervision at University of Siegen has been great so far. The ESR is well integrated into the group already and busy learning German.



Ngiyabonga!

Questions?

